

## **Congressional Notification Profile**

***DE-PS26-02NT41369***

UNIVERSITY COAL RESEARCH PROGRAM, INNOVATIVE CONCEPTS PROGRAM

University of Pittsburgh

### **Background and Technical Information:**

**Project Title:** "Engineered Particulates for Co-Firing of Diverse Feedstocks."

The University of Pittsburgh proposes to develop a novel method of forming and controlling agglomerate. The goal is to use this novel technique to form energy-relevant controlled that would be ideal in cofiring diverse feedstocks, such as in combustion power-based systems.

Such a development would prove important at a time when significant research has been applied to combining various fuels — coal, char, biomass, limestone — in power-based systems. Most, if not all, of these feedstocks have complex particle shapes and very different sizes and other properties, such as moisture content, when compared to conventional fuels. Inconsistent factors to inefficient and inconsistent operation of combustion systems.

### **Contact Information:**

Selectee: University of Pittsburgh

Business Contact: Michael M. Crouch

Business Office Address: 350 Thackeray Hall  
University of Pittsburgh  
Pittsburgh, PA 15260

Phone Number: 412-624-7400

Fax Number: 412-624-7409

E-mail: offers@orserver.off-res.pitt.edu

Congressional District: PA 14<sup>th</sup>

County: Allegheny

### **Financial Information:**

Length of Contract (months): 12

Government Share: \$50,000

Total value of contract: \$50,000

### **DOE Funding Breakdown:**

Funds: FY 2002 \$50,000

## **Public Abstract**

**Project Title:** Engineered Particulates for Co-Firing of Diverse Feedstocks  
(in response to DOE/NETL Solicitation No. DE-PS26-02NT41369)

**PI:** Joseph J. McCarthy, Assistant Professor (mccarthy@engrng.pitt.edu)  
Chemical and Petroleum Engineering Department  
University of Pittsburgh, Pittsburgh, PA 15261 (412) 624-7362

Recently, for reasons of both energy efficiency and environmental expediency, there has been an increased interest in combining differing fuels – such as coal, char, biomass, limestone, etc – in combustion-power based systems. In these systems, it is imperative that flows are both continuous and uniform for proper operation of the combustors; however, most, if not all, of the feedstocks which have been proposed as potential coal co-firing agents have complex particle shapes and very different sizes and properties when compared to conventional fuels. Moreover, many of these materials tend to be cohesive due to high moisture content and/or small particle size. These factors contribute to making the attainment of consistent concentration and flow in co-firing plants technologically challenging and often lead to inefficient and inconsistent operation of combustion systems.

A growing trend in particle technology is the development of engineered particulates or controlled agglomerates. Engineered particulates are ideally suited for co-firing applications, being marco-particles or agglomerates of several differing types of primary particles in specific proportions. Typical methodologies for producing engineered particles, however, are unsuitable for co-firing application (either because of expense or due to limitations on material characteristics). This proposal explores a unique methodology for agglomerate formation/control which exploits theory based on simple, discrete-level reasoning and “thermodynamic” arguments. The goal is to use this novel technique to form energy-relevant controlled agglomerates for use in the co-firing of diverse feedstocks. It is expected that developing these engineered particulates will result in easier handling and more consistent and reliable transport and flow of diverse feedstocks, thus allowing greater efficiency for co-fired combustion systems.

A combination of discrete simulation and experimentation will be used toward attaining this goal. In preliminary work, controlled agglomerates (or ordered mixtures) have been successfully obtained for wet, cohesive particles in well-controlled rotary drum experiments. All our current experimental and computational findings are in direct agreement with our existing theory. The proposed work extends our existing theory to a wider range of shearing environments as well as gas-solid flows so that we may predict the stability of our agglomerates under varying conditions. Moreover, we plan to explicitly test our theoretical results not only with model particles (glass and plastic spheres), but also with energy-relevant stock (such as biomass and coal).